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The Relationships Among Imagery Use, Imagery Ability And Mental Toughness In Adolescent Figure Skaters

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THE RELATIONSHIPS AMONG IMAGERY USE, IMAGERY ABILITY AND MENTAL TOUGHNESS IN ADOLESCENT FIGURE SKATERS

by

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This Thesis, submitted by Michele Sullivan in partial fulfillment of the requirements for the Degree of Master of Science in Kinesiology from the University of North Dakota, has been ready by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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This thesis is being submitted by the appointed advisory committee as having met all of the requirements of the School of Graduate Studies at the University of North Dakota and is hereby approved.

Wayne Swisher
Dean of the School of Graduate Studies

July 9, 2015
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PERMISSION

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Michele Sullivan
June 24, 2015

TABLE OF CONTENTS

LIST OF TABLES

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ABSTRACT

Coaches and athletes have requested strategies that develop and maintain mental toughness because they find it to be an essential part of performance (Clough, Earle, & Sewell, 2002). Yet, little research has been conducted to examine psychological skills that contribute to gain and maintain mental toughness. This study examines imagery and mental toughness in adolescent figure skaters. Imagery use was assessed by the Sport Imagery Questionnaire- Children (Hall, Munroe-Chandler, & Fishburne, 2009) and imagery ability with the Movement Imagery Questionnaire-Children (Martini, Carter, Yoxon, Cumming, & Ste-Marie, submitted December 2014). Mental toughness was assessed using the Mental Toughness Index (Gucciardi, Hanton, Gordon, Mallet, & Temby, 2014). A stepwise multiple regression analyses indicated that imagery is a predictor of mental toughness. The only significant predictor variable was MG-M imagery. Therefore, if an athlete wishes to gain mental toughness the best predictor would be to imagine the individual is in control and confident. Further research should explore mental toughness in relation to other psychological skills.

CHAPTER 1

INTRODUCTION

Coaches and athletes have requested strategies that develop and maintain mental toughness because they find it to be an essential part of performance (Clough, Earle, & Sewell, 2002). Yet, mental toughness is still one of the least studied mental skills in sport psychology research (Jones, Hanton, & Connaughton, 2002). Contributing to the lack of research in this area has been conceptual confusion regarding the definition of mental toughness and methodological concerns with its corresponding measurement (Gucciardi, Hanton, Gordon, Mallett, & Tembly, in press). For the purposes of this thesis, mental toughness is defined as: "a personal capacity to produce consistently high levels of subjective (e.g., personal goals or strivings) or objective performance (e.g., sales, race times, GPA), despite everyday challenges and stressors as well as significant adversities" (Gucciardi et al., 2014 p. 218).

Researchers have shown that mental toughness is best conceptualized as a state-like concept in that it is developmental and can be modified through new learning (Harmison, 2011). In that sense, mental toughness is best considered a characteristic adaption, or a contextualized expression of dispositional traits that are activated or shaped by contextual or social factors (e.g., self-beliefs) (Gucciardi et al., 2014). Given this

conceptualization of mental toughness, it follows that it should be changeable via psychological skills training interventions (e.g., Gucciardi, Gordon, & Dimmock, 2009).

Basic psychological skills are used to regulate an athlete's anxieties, self-confidence, motivation, and attention. These skill sets include mental imagery, goal-setting, relaxation, and self-talk (Moris, Spittle, & Watt, 2005). As stated above, the definition of mental toughness includes repetition of subjective or objective performance. In doing so it is necessary athletes possess self-confidence, motivation, and attentional properties. The need for psychological skills training is important, yet, the relationships among psychological skills and mental toughness has received less research attention.

Psychological skills training has been shown to enhance mental toughness in athletes. In their study, Gucciardi et al. compared two psychological skills training groups with a control group using youth football teams. The first psychological training group targeted the key aspects to mental toughness identified by Gucciardi, Gordon, and Dimmock (2008). The four key aspects: thrive through challenge, sport awareness, tough attitude, and desire success. Group two focused on arousal regulation, mental rehearsal, attentional control, and self-efficacy and ideal performance. Over a six week time period, a two hour session was conducted each week before the athlete's competitive season. Participants were asked to recall past events to gain self-efficacy or work towards an ideal performance. Both psychological skills training interventions were effective

compared to the control group. Further research on mental toughness and psychological skills has been done with self-talk, emotional control, and relaxation strategies in competition and practice (Crust & Azadi, 2010). Through questionnaires, Test of Performance Strategies (TOPS; Thomas et al., 1999) and MTQ48 (Clough et al., 2002) the study results indicate that psychological skills were a positive impact on gaining mental toughness in training and competition. Researchers, Crust and Azadi, suggest researching mental toughness and the independent impact of each psychological skill.

Mental imagery is one of the most used psychological skills. Barry and Hall, used imagery to reduce anxieties in athletes, this allowed them to enhance performance (1992). It has become a common practice for individual competitors and team athletes to use mastery imagery to gain confidence and enhance performance in sport (e.g., Kizildag & Sefik Tiryaki, 2012).

Imagery has been defined as a quasi-sensory or quasi-perceptual experience of which we are self-consciously aware, and which exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts, and which may be expected to have different consequences from their sensory or perceptual counterparts (Richardson, 1969). Within sport, imagery is generally studied using Paivio's (1985) framework. According to Paivio, imagery can have cognitive and motivational functions and can operate on general or specific levels. The five different functions of imagery are as follows: cognitive general imagery (CG) is used

when an individual visualizes strategies or routines. Most figure skaters, for example, would use CG in daily practice when they are going over routines. Cognitive specific imagery (CS) is when an athlete imagines a specific element. In figure skating, the athletes may use CS while learning a new jump. Motivational general-arousal imagery (MG-A) is used when an athlete images emotional experiences in sport, such as being relaxed. Motivational general-mastery imagery (MG-M), is when an athlete imagines being mentally tough, in control, and confident. This function of imagery would help a figure skater gain confidence overall with their skating ability. Motivational specific imagery (MS) involves imaging completing specific goals, or goal-oriented achievement. For example, an athlete visualizes winning first place and identifies what it feels like to stand on the podium.

Paivio's (1985) framework was used as the centerpiece in an imagery use model proposed by Martin, Moritz, and Hall (1999). The model explains how athletes can use imagery for cognitive, affective, and behavioral outcomes. The basic premise of the model is that the imagery content is tied to the outcome. For example, if an athlete wished to gain confidence, then the athlete should imagine being confident (i.e., an MG-M type of image). As applied to mental toughness, the model would suggest that if an athlete wishes to be mentally tough then they should be using MG-M imagery because this type of image is also associated with this function. They also included imagery ability which is defined as an individual's ability to generate and use imagery (Paivio,

1985). Imagery ability was thought to improve sports performance and demonstrate greater improvement in performance over time (Vadocz et al., 1997). The model shows that imagery ability works as a moderator between imagery type and desired outcome for the athlete. An athlete's imagery ability may have an impact on an athlete's development of mental toughness.

A theoretical link between mental toughness and imagery has been established. Little research has been conducted on both constructs together. Below is a review of what has been established and where further research should be conducted.

The first studies linking imagery with mental toughness were conducted by Moritz, Martin, Hall, and Vadocz (1996), and Vadocz, Short, and Hall (1997). Using elite roller skaters, their results showed that athletes who imagined themselves confident and mentally tough through MG-M imagery had higher levels of self-confidence. These studies demonstrate the importance of imaging being mentally tough with respect to self-confidence.

In a qualitative study examining imagery use in sport, Munroe et al. (2000) explored the four W's of imagery use: where, when, why and what in sport. Elite athletes (seven females and seven males) participated in the study. An interview was conducted and asked each participant to explain their personal use of imagery. Questions were specific and geared towards imagery use in practice and competition. Another set of

questions were asked specific to Paivio's (1985) model of imagery. For example, a cognitive general question was, "Could you describe your use of imagery to rehearse and execute strategies of play?" A specific question was included for CS, CG, MS, MG-M, and MG-A. The results showed that MG-M imagery was used to enhance mental toughness. Three other themes were associated with MG-M imagery: focus, confidence, and positivism (Munroe et al., 2000).

The most direct study linking imagery and mental toughness was done by Mattie and Monroe-Chandler (2011). Participants were 151 varsity collegiate athletes from a Southwestern Ontario University. Males and females were both included in the sample and all participants were in season during their involvement with the study. Each participant completed the Sport Imagery Questionnaire (Hall et al., 1998) and The Mental Toughness 48 Inventory (Clough et al., 2002). The results showed imagery does, in fact, have an impact on mental toughness. Specifically, MG-M imagery was a strong predictor of mental toughness. Therefore, an athlete should imagine feeling in control and confident in order to increase mental toughness in sport.

There were some limitations to Mattie and Monroe-Chandlers study indicating a need for further research on mental toughness and imagery. The first limitation entails disconnect in the definition of mental toughness and the measure used to assess the construct. Mattie and Munroe-Chandler (2011) used a mental toughness definition in line with Gucciardi, Gordon, and Dimmock (2009). Yet the measure they

used was from Clough et al. (2002). This mismatch is significant given the different conceptualizations of mental toughness proposed by the two groups of researchers. There were low alpha values on the MTQ-48 ranging from .66-.74. Another limitation concerns the assessment of imagery ability. There was no measure of the participant's imagery ability in the study this is a problem because without the knowledge of participants' imagery ability it is difficult to assess the impact imagery has on mental toughness. If an athlete has a low imagery ability score it is likely that building mental toughness would be difficult for the individual. Before the athlete can become mentally tough they would need to work on imagery ability. Imagery and mental toughness are both developmental skills and can complement each other if assessed accordingly.

The purpose of this study is to further explore mental toughness and imagery with different population groups specifically, figure skaters. It fills a gap in the literature by examining mental toughness with different age and competitive levels (Mattie and Chandler, Munroe, 2011), by including conceptually consistent definitions and measures for mental toughness, and figure skaters, and by including the assessment of imagery ability.

CHAPTER II

METHOD

Participants

This study consisted of 42 competitive adolescent figure skaters from the BorderBlades Figure Skating Club in Grand Forks, North Dakota. Ages ranged from 8-18 years. Figure skaters are an ideal population group for imagery studies. A study identified that imagery enhances a figure skaters performance (Hall and Rogers, 1989). The results indicate figure skaters contain a natural disposition to imagery due to the nature of the sport. It was also stated, children are more open to imagery because of regular engagement in play time. In addition, many children have creative and imaginative minds (Hall and Rogers, 1989).

Measures

Demographics-Participants were asked age, gender, years in sport and level.

Imagery use questionnaire-The Sport Imagery Questionnaire- Children (Hall, Munroe-Chandler, Fishburne, 2009) was used to assess the athlete's use of imagery. It is based off of the Sport Imagery Questionnaire (Hall et al., 2005). The SIQ-C has five subscales that assess both cognitive and motivational imagery use. There are four questions related to each subscale, however, Motivation general mastery contains five questions. The five subscales are as follows: Cognitive specific (CS; e.g. imagining

perfect sports skill) an example, "I can usually control how a skill looks in my head", Cognitive general (CG; e.g. Imagining strategies or routines) an example "I make up new game plans or routines in my head", Motivation specific (MS; e.g. imagining certain goals with preferred outcome) an example from the questionnaire is " I see myself doing my very best", and Motivation general-arousal (MG-A; e.g. imagining emotions that present during competition) an example "In my head, I imagine how calm I feel before I compete" and Motivation general-mastery (MG-M; e.g. imagining how to work, through problems) an example "I imagine myself being confident in competition". The SIQ-C is rated on a 5-point Likert scale (1= not at all and 5= very often).Participants circle the number that is most like them. Each time a participant circles an imagery situation the scoring goes up for that function of imagery. Alpha subscales range from.69-.82 demonstrating strong internal reliability (Hall, Munroe-Chandler, Fishburne, 2009).

Imagery ability questionnaire-Movement Imagery Questionnaire-Children. The Movement Imagery Questionnaire-Children (Martini, Carter, Yoxon, Cumming, & Ste-Marie, submitted December 2014) is based off The Movement Imagery Questionnaire (MIQ-R) (Hall & Martin, 1997). The scale measured both visual and kinesthetic imagery ability. The MIQ-R consists of 8 items designed to measure the visual and kinesthetic imagery of movement. Each item in the questionnaire involves executing a movement, which specifically describes a variety of arm, leg and whole body movements. All movements are relatively simple to ensure that most individuals can perform them.

Completing an item on the questionnaire requires several steps. First, the starting position for a movement is assumed. Second, the movement is produced as described. Third, the starting position is reassumed and finally, the movement is imaged (no movement is actually performed). The imager then assigns a value from a 7-point rating scale regarding the ease/difficulty with which the movement was imaged; a low rating indicated that a movement is hard to image; a high rating indicates that a movement is easy to image.

Differences with the MIQ-C entail 12 items and the participants engage in each movement to ensure there is a proper understanding in order to obtain correct measurements. After participants engage in the movement and imagine the movement in their head they were then asked to rate imaging the movement as one of the following: very hard, hard, kind of hard, not easy nor hard, kind of easy, easy of very easy. Participants were asked to complete each exercise and write down a rating that applies to the individual. Scores were added for each subscale; internal visual imagery, external visual imagery, and kinesthetic imagery. Each subscale score is divided by four to determine the participant's imagery ability.

Mental toughness questionnaire-Mental Toughness Index. The Mental Toughness Index (Gucciardi, Hanton, Gordon, Mallett, & Temby, 2014) assessed mental toughness as a unidimensional construct. Each question was designed to answer the key dimensions of mental toughness: Generalized self-efficacy, Buoyancy, Success mindset,

Optimistic style, Context knowledge, Emotion regulation, and Attention regulation. Each question was adaptable to different domains such as education, sport, and military. The 8 items are answered on a 7-point Likert scale (1= false, 100 percent of the time and 7= true, 100 percent of the time). Ratings were totaled together and a higher score indicated higher levels of mental toughness in an individual. Internally reliable with an alpha coefficient of .86 within convenient samples located in Australia (Gucciardi, Hanton, Gordon, Mallet, & Temby, 2014).

Procedure

Approval to conduct this study was obtained from the University of North Dakota Institutional Review Board. Parents at the BorderBlades Figure Skating Club were contacted personally and asked if they would allow their athletes to participate. The principal researcher held an informative meeting to parents about the study. Informed consents were administered and signed. Participants were administered questionnaires to complete the study. The first round did not receive an adequate amount of participants. As a result, the researcher obtained parental consent and had athletes complete the questionnaires during the BorderBlades ice show.

Analysis

Analysis of variance was conducted to determine differences between demographic variables (age, gender, years in sport, and level) and the SIQ-C, MIQ-C, and MTI subscales. A stepwise multiple regression analyses was conducted to determine if imagery ability and imagery use predict mental toughness. Followed by an analyses of variance and multivariate analyses of variance. Correlations were used to determine SIQ-C, MIQ-C, and MTI scores to associate intercorrelations as well as significates with other scales.

CHAPTER III

RESULTS

Before conducting the analyses all data were examined for missing variables or outliers. The next step was to examine the reliability for the subscales of the SIQ-C and the MIQ-C, as well as the MTI using Cronbach's Alpha. Alpha coefficients ranged from .60-.67 for the SIQ-C (CS=.67, CG=.60, MS=.66 MG-M=.66, MG-A=.67). These values were in line with other SIQ-C research where Alphas have ranged between .62 and .83 for the SIQ-C subscales (Hall, Munroe-Chandler, Fishburne & Hall, 2009; Munroe-Chandler, Hall, & Fishburne, 2008). In this study, five participants within the study were older than 14 years of age – the SIQ-C was developed for participants between the ages of 7 and 14 years. Alpha coefficients without the five older individuals showed a similar range from .60-.67 (CS=.60, CG=.60, MS=.62, MG-M=.63, MG-A=.67). Thus, for all other analyses, the entire sample was used. Although Nunnally has proposed .70 as a minimum threshold for acceptable internal consistency reliability, Devellis (1991) noted that it is not uncommon to see published scales with lower alphas (e.g., .60–.69). In addition, Patten (2014) stated that measures with Alpha values as low as .50 can be used if group averages are being used. Furthermore, in the research by Hall et al. (2009) and Munroe-Chandler et al. (2009), they performed all analyses despite the lower Alphas values.

Reliability coefficients for the MIQ-C ranged from .51-.69 (Kinesthetic imagery ability = .69, Visual Internal imagery ability = .66, Visual External imagery ability = .51).

The correlation between visual internal imagery and visual external imagery was high at .89, so they were combined into a single variable representing visual imagery ability (Alpha = .89). MT had an Alpha coefficient of .88.

Descriptive statics

Descriptive statistics are in Table 1. Results for the SIQ-C indicated that the participants were using imagery on a regular basis. For all subscales, the means were above 3.0, corresponding to "sometimes" and "very often." Participants reported using MS the most, followed by MG-M, and MG-A. Means for the MIQ-C were above 6 indicating that imagery was "easy" for figure skaters engage in. There was no difference in mean scores between kinesthetic imagery ability (6.40) and visual imagery ability (6.41). The mean for MT was above the midpoint at 5.43 (range 1 to 7) indicating that the sample was overall mentally tough.

Table 1 Means and Standard Deviations for the SIQ-C, MIQ-C, and MT

Variables	Total		High MT		Low MT	
	Mean	SD	Mean	SD	Mean	SD
SIQ-C						
CS	3.35	.63	3.57	.58	3.09	.62
CG	3.56	.66	3.72	.66	3.37	.61
MS	3.90	.69	4.04	.72	3.74	.63
MG-A	3.80	.67	4.07	.53	3.47	.70
MG-M	3.83	.53	4.00	.52	3.63	.49
MIQ-C						
KIN	6.40	.76	6.59	.63	6.18	.86
VIS	6.41	.68	6.49	.73	6.30	.62
MT	5.43	.81	6.00	.43	4.73	.57

Note. SIQ-C = Sport Imagery Questionnaire- Children, CS = Cognitive Specific, CG = Cognitive General, MS = Motivational Specific, MG-A = Motivational General-Arousal, MG-M = Motivational General Mastery, MIQ-C = Movement Imagery Questionnaire-Children, KIN = Kinesthetic Imagery Ability, VIS = Visual Imagery Ability, MT = Mental Toughness. The SIQ-C is rated on a 5-point Likert scale and anchored at 1(*not at all use that type of imagery*) to 5 (*very often use that type of imagery*). The MIQ-C is rated on a 7 –point Likert scale ranging from 1 (*very hard*) to 7 (*very easy*). The MTI rated on a 7-point Likert ranging from 1 (*false, 100% of the time*) to 7(*true, 100% of the time*).

To see if there were differences in imagery use according to mental toughness, a mean split was used to classify participants. Nineteen participants were classified as "low mental toughness" and 23 participants were classified as "high mental toughness." A *t*-test indicated that these groups differed significantly on mental toughness scores, $t\ (40) = -8.25$, $p < .00$. A 2-level (high versus low mental toughness) multivariate analysis of variance (MANOVA) was conducted using the SIQ and MIQ-C subscale scores as the dependent variables (for descriptive statistics, see Table 1). A significant multivariate effect emerged, Wilks' Lambda (5, 36) = 2.41, $p = .055$, observed power = .70. Post-hoc univariate analyses (ANOVAs) were statistically significant for three subscales showing that athletes higher in mental toughness used more CS imagery ($F\ (1, 40) = 6.57$, $p = .014$, $\eta^2 = .14$, observed power = .71), MG-M imagery ($F\ (1, 40) = 5.50$, $p = .024$, $\eta^2 = .12$, observed power = .63), and MG-A imagery ($F\ (1, 40) = 9.70$, $p = .003$, $\eta^2 = .20$, observed power = .86) compared to those who were lower in mental toughness.

Correlations computed among the SIQ-C subscales were statistically significant and small to moderate in size ranging from .35- .67 (see Table 2). For the MIQ-C, the correlation between visual imagery ability and kinesthetic imagery ability was high ($r = .83$, $p < .01$). Intercorrelations among the SIQ-C and MIQ-C subscales showed significant results for MS and kinesthetic imagery ability ($r = .33$, $p < .05$). The range of correlations among the MTI and SIQ-C subscales was .36-.54, all statistically significant. MT was also significantly correlated with kinesthetic imagery ability ($r = .35$, $p < .01$).

Table 2 Bivariate Correlations between Subscales of the SIQ and MTI

	CS	CG	MS	MGA	MGM	VIS	KIN	MT
CS	1.00							
CG	.66**	1.00						
MS	.36*	.40**	1.00					
MG-A	.40**	.49**	.35*	1.00				
MG-M	.51**	.67**	.64**	.65**	1.00			
VIS	-.03	.16	.29	-.03	.09	1.00		
KIN	.09	.20	.33*	.12	.20	.83**	1.00	
MT	.47**	.36*	.50**	.52**	.54**	.19	.35*	1.00

Note. CS = Cognitive Specific, CG = Cognitive General, MS = Motivational Specific, MG-A = Motivational General- Arousal, MG-M = Motivational General-Mastery, VIS = Visual Imagery Ability, KIN = Kinesthetic Imagery Ability, MT = Mental Toughness. *$p < .05$ level. **$p < .01$.

One stepwise multiple regression analyses was conducted to determine if imagery ability and imagery use could predict mental toughness. The dependent variable was MT, the predictors were the SIQ-C subscales and the MIQ-C subscales. The regression was statistically significant ($R = .53$, $R^2 = .28$, $F\ (1, 40) = 15.38$, $p = .00$). The only significant predictor variable was MG-M ($\beta = .53$, $t = 3.92$, $p = .00$).

CHAPTER IV

DISCUSSION

This study supports previous research on imagery and mental toughness. Results of this study showed that MG-M imagery was associated with mental toughness in athletes. MG-M imagery was the only predictor in the regression, it had the highest correlation among all imagery subscales with mental toughness, and the ANOVA demonstrated participants with higher mental toughness scores used MG-M imagery more often than participants who were not as mentally tough. These findings are the same as other studies (Martin et al., 1999; Munroe, 2000; Munroe-Chandler & Mattie, 2011) that also showed the relationships among imagery and mental toughness.

Although MG-M imagery was the only significant predictor of mental toughness in the stepwise multiple regression analyses, correlations demonstrated that every imagery subscale were positively related to mental toughness. ANOVA results showed that athletes who had higher scores on mental toughness used imagery more than those who were less mentally tough. For the overall sample, the three most used forms of imagery were MS, MG-M, and MG-A. This finding is consistent with other researchers who have shown that motivational imagery is more related to psychological states like mental toughness and confidence compared to cognitive imagery (e.g., Moritz et al., 1996; Vadocz et al., 1997). It is not that using cognitive types of imagery will not affect mental toughness, but rather that motivational imagery is more likely to be effective.

The findings of this study are beneficial because little research has been conducted on mental toughness and imagery. Many athletes and coaches have requested psychological skills training programs for athletes to improve on their mental toughness. The accumulation of evidence shows that there is a relationship between imagery and mental toughness, and future researchers and applied sport psychologists should consider using imagery to change mental toughness in psychological skills training interventions. This information indicates that the use of imagery can develop mental toughness in an athlete. Similar to suggestion made by Moritz et al. (1996), we suggest that if people want to develop mental toughness through imagery they should imagine being mentally tough (using motivational imagery). Imagery interventions are often dependent on athletes' having the ability to image, however. Therefore, it is important to assess imagery ability in athletes. If an athlete has difficulties with imagery the intervention may take more time.

Imagery ability was also considered in this study because the first study to examine mental toughness and imagery (i.e., Mattie & Munroe-Chandler, 2011) did not include it and other researchers (e.g., Moritz et al., 1996; Vadocz et al., 1998) have shown that there is a relationship among imagery ability, imagery use and psychological variables like confidence and anxiety. In this study, the athletes were good imagers with mean scores above 6 on a 7 point Likert scale. There were no differences in imagery ability between those who were high and low on mental toughness. Imagery ability was

not a significant predictor of mental toughness in the regression equation, however, the correlation between kinesthetic imagery ability and MT was significant. These results support evidence that kinesthetic imagery is more strongly related to psychological states (like confidence and MT), compared to visual imagery ability. Low imagery ability does not mean that imagery use is not a predictor of mental toughness. Rather it can identify that it will take more time for an athlete to use imagery to gain mental toughness. Just as imagery use improves so can imagery ability (Rodgers et al., 1991).

It may be difficult to assess imagery ability because of a measurement related issue with the MIQ-C. One of the issues was with low Cronbach's Alpha values for all of the subscales. In addition, the MIQ-C was designed to have 3 subscales - visual internal imagery, visual external imagery and kinesthetic imagery ability – incorporating imagery perspective into the measure. The correlation between the two visual imagery ability subscales was very high at .89. Therefore, given the potential redundancy in measurement, we combined the scales into a single variable representing visual imagery ability and doing so increased the Alpha value to an acceptable level. Given that the SIQ-C is a new measure, there is not much to compare with to see if these limitations were specific to this study or the measure in general.

Similar to the MIQ-C, the SIQ-C also had some measurement issues. The Alpha values were also considered low but were in line with values reported by other researchers who used the measure (Hall, Munroe-Chandler, Fishburne & Hall, 2009;

Munroe-Chandler, Hall, & Fishburne, 2008). The SIQ-C was developed for athlete's ages 7-14 years. This study had five participants older 14. To see if this age issue made a difference, these five participants were dropped, but the re-analysis showed that the Alpha levels stayed in the similar range of .60-.67. Low Alpha levels are naturally alarming, however, Patten (2014) stated that measurements with reliability coefficients as low as .50 can be serviceable when data analysis uses group averages with 25 or more participants.

With respect to measurement and the Mental Toughness Index, the psychometrics of this measure included college-aged samples. The sample in this study was young figure skaters ranging in age from 8-18 years. The Alpha value for the MTI was .88, indicating high internal consistency. The results using the MTI were consistent with expectations and previous research. The sample used in this study was on the high side of mentally tough athletes. A mean score of 5.43 that ranged on a Likert point scale from 1-7 indicates above average results. The only other study that has examined mental toughness and imagery in athletes is Mattie and Munroe-Chandler (2012). Their study used the Mental Toughness 48 Inventory (MT48: Clough et al., 2002) with subscales of Control, Commitment, Challenge, and Confidence. Results from their study had mean scores ranging from 3.36-3.75 based off of a 5- point Likert scale, indicating their sample was also mentally tough. Overall, the participants in this study were able to comprehend questions and the measurement scale for the MTI. Thus, even though it was designed for

an older sample of participants, it seemed to work fine with the younger group. A MTI – for Children measure may be beneficial in the future, but until then the MTI is showing to work as an alternative.

Now that an association between mental toughness and imagery has been identified with multiple age groups future researchers should examine what types of imagery intervention techniques can be used to develop, maintain or regain mental toughness. Psychological skills training programs that include imagery can be developed and implemented in an applied setting. It would be beneficial for researchers to assess what other types of psychological skills (e.g., anxiety control/ arousal regulation, goal-setting, self-talk) have relationships with mental toughness.

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VIS	6.41	.68	6.49	.73	6.30	.62
MT	5.43	.81	6.00	.43	4.73	.57

Note. SIQ-C = Sport Imagery Questionnaire- Children, CS = Cognitive Specific, CG = Cognitive General, MS = Motivational Specific, MG-A = Motivational General-Arousal, MG-M = Motivational General Mastery, MIQ-C = Movement Imagery Questionnaire-Children, KIN = Kinesthetic Imagery Ability, VIS = Visual Imagery Ability, MT = Mental Toughness. The SIQ-C is rated on a 5-point Likert scale and anchored at 1(*not at all use that type of imagery*) to 5 (*very often use that type of imagery*). The MIQ-C is rated on a 7 –point Likert scale ranging from 1 (*very hard*) to 7 (*very easy*). The MTI rated on a 7-point Likert ranging from 1 (*false, 100% of the time*) to 7(*true, 100% of the time*).

Table 2. Bivariate Correlations between Subscales of the SIQ and MTI

	CS	CG	MS	MGA	MGM	VIS	KIN	MT
CS	1.00							
CG	.66**	1.00						
MS	.36*	.40**	1.00					
MG-A	.40**	.49**	.35*	1.00				
MG-M	.51**	.67**	.64**	.65**	1.00			
VIS	-.03	.16	.29	-.03	.09	1.00		
KIN	.09	.20	.33*	.12	.20	.83**	1.00	
MT	.47**	.36*	.50**	.52**	.54**	.19	.35*	1.00

Note. CS = Cognitive Specific, CG = Cognitive General, MS = Motivational Specific, MG-A = Motivational General- Arousal, MG-M = Motivational General-Mastery, VIS = Visual Imagery Ability, KIN = Kinesthetic Imagery Ability, MT = Mental Toughness. *$p < .05$ level. **$p < .01$.

APPENDICES

Appendix A
Sport Imagery Questionnaire for Children (SIQ-C)
(Hall, Munroe-Chandler, Fishburne, and Hall, 2009)

Age: _____

Number of years as a figure skater: ____

Gender: Male____ Female____

Directions: Imagery is a mental skill that is used to create and re-create pictures in your mind. Athletes use imagery in practices and in competition. Imagery can be used to see different skills in your head and can also be used to help with your confidence and nervousness. This questionnaire measures how you are using imagery. Any statement that explains an imagery situation that you often use should be given a high number.

The statements will be scored from 1-5. Please read each statement and then circle the number that most applies to you for that statement. Feel free to use a number more than once and remember—there are no right or wrong answers.

Not at all	**A little bit**	**Sometimes**	**Often**	**Very often**
1	**2**	**3**	**4**	**5**

In figure skating….

1. I make up new game plans or routines in my head.

Not at all	**A little bit**	**Sometimes**	**Often**	**Very often**
1	**2**	**3**	**4**	**5**

2. I see myself doing my very best

Not at all **1**	**A little bit** **2**	**Sometimes** **3**	**Often** **4**	**Very often** **5**

3. I imagine myself being confident in competition.

Not at all **1**	**A little bit** **2**	**Sometimes** **3**	**Often** **4**	**Very often** **5**

4. In my head, I imagine how calm I feel before I compete.

Not at all **1**	**A little bit** **2**	**Sometimes** **3**	**Often** **4**	**Very often** **5**

5. I see what I would do if my game plans or routines do not work out.

Not at all **1**	**A little bit** **2**	**Sometimes** **3**	**Often** **4**	**Very often** **5**

6. I imagine myself staying calm in competitions**.**

Not at all **1**	**A little bit** **2**	**Sometimes** **3**	**Often** **4**	**Very often** **5**

7. I imagine other people telling me that I did a good job.

Not at all **1**	**A little bit** **2**	**Sometimes** **3**	**Often** **4**	**Very often** **5**

8. I can usually control how a skill looks in my head.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

9. I see the audience cheering for me.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

10. When I think of doing a skill, I always see myself doing it perfectly.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

11. I imagine continuing with my game plan or routine even if it is not going well.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

12. When I think of a competition, I imagine myself getting excited.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

13. Before trying a skill, I see myself doing it perfectly.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

14. I see myself being mentally strong.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

15. I imagine how exciting it is to be in a competition.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

16. I see myself as a champion.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

17. I see myself being focused in a tough situation.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

18. When learning something new, I see myself doing it perfectly.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

19. I see myself being in control in tricky situations.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

20. I see myself following the game plan or routine at competitions.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

21. I see myself getting through tough situations with good results.

Not at all	A little bit	Sometimes	Often	Very often
1	2	3	4	5

APPENDIX B
Mental Toughness Index
(Gucciardi, Hanton, Gordon, Mallett, Temby, *in press*)

Directions: Using the scale below, please indicate how true each of the following statements is an indication of how you typically think, feel, and behave as an athlete- Remember there are no right or wrong answers so be as honest as possible.

1 False, 100% of the time	2	3	4	5	6	7 True, 100% of the time

1. I believe in my ability to achieve my goals.

1 False, 100% of the time	2	3	4	5	6	7 True, 100% of the time

2. I am able to regulate my focus when performing tasks.

1 False, 100% of the time	2	3	4	5	6	7 True, 100% of the time

3. I am able to use my emotions to perform the way I want to.

1 False, 100% of the time	2	3	4	5	6	7 True, 100% of the time

4. I strive for continued success.

1 False, 100% of the time	2	3	4	5	6	7 True, 100% of the time

5. I execute my knowledge of what is required to achieve my goals.

1 False, 100% of the time	2	3	4	5	6	7 True, 100% of the time

6. I consistently overcome adversity.

1 False, 100% of the time	2	3	4	5	6	7 True, 100% of the time

7. I am able to execute appropriate skills or knowledge when challenged.

1 False, 100% of the time	2	3	4	5	6	7 True, 100% of the time

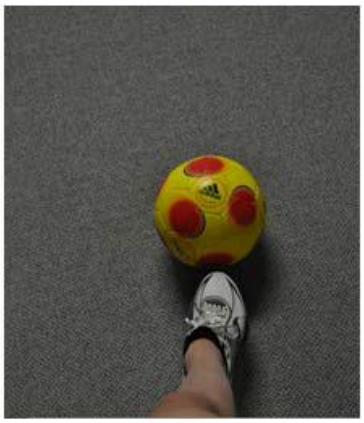
8. I can find a positive in most situations.

1 False, 100% of the time	2	3	4	5	6	7 True, 100% of the time

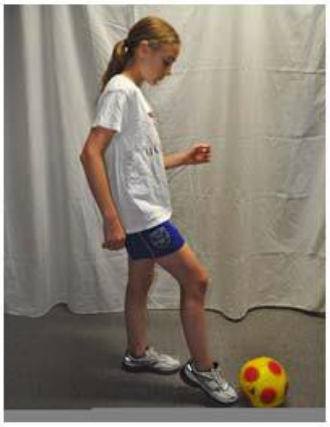
APPENDIX C

Movement Imagery Questionnaire- Children

(Martini, Carter, Yoxon, Cumming, & Ste-Marie, submitted December 2014)



Internal Visual Imagery
(1st Person Perspective)



External Visual Imagery
(3rd Person Perspective)

Glass of Mud
(Very hard to…see or feel)

Glass of cloudy water
(Not easy nor hard…to see or feel)

Empty Glass
(Very easy to…see or feel)

1	2	3	4	5	6	7
Very Hard	Hard	Kind of Hard	Not Easy nor Hard	Kind of Easy	Easy	Very Easy

Write your ratings in each box below:

1.	7.
2.	8.
3.	9.
4.	10.
5.	11.
6.	12.

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